REPORT ON CHEMICAL AND CEMENT GROUTING TO REDUCE WATER LEAKAGE

DOMTAR NO. 3 GYPSUM MINE

CALEDONIA, ONTARIO

GROUNDATION ENGINEERING CONTRACTORS LTD.
GEORGETOWN, ONTARIO
SEPTEMBER 1990

Work on the project was conducted under they auspices of the Canada Centre for Mineral and Energy Technology, Energy Mines and Resources Canada

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MICROMEDIA

TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY

2.0 SOMMAIRE

3.0 TECHNICAL DISCUSSION

- 3.1 General Description of the Mine
- 3.2 Planned Methods to Stop Water Flow
- 3.3 Equipment Used
- 3.4 Material Used
- 3.5 Use of the Chemical Grout
- 3.6 Surface Grouting Program

4.0 PROJECT STATISTICS

5.0 OBSERVATIONS

6.0 CONCLUSIONS

Appendix A - Technical Data Regarding the Polyurethane Grouts

1.0 EXECUTIVE SUMMARY

The Domtar No. 2 Gypsum Mine was experiencing water inflows of the order of 500 gallons per minute in one section of the mine. The rock in this vicinity contains gypsum with pre-established patterns of voiding and honeycombing.

A grouting program was undertaken to cut down the inflow by filling the voids and by cutting off the flow of water from reaching the mine. The grouting program utilized both cement grout, hydrophobic polyurethanes and hydrophilic polyurethanes.

The flow was successfully reduced to a manageable level in this grouting program. It was found that the void system in the rock was extensive and wide spread. The extensive nature of the void system required the use of the inexpensive cement grouts for basic void filling. The polyurethane grouts were very successful as a means to stop water flow to permit definitive grouting and were reasonably successful as a means of injecting and sealing smaller fissures. They were neither effective nor economical in sealing from large cavities into small fissures.

1.1 SOMMAIRE

Une section de la mine de gypse numero deux de Domtar admettait des venues d'eau de l'ordre de 500 gallons par minute. La roche des environs renferme du gypse qui contient une système preexistant de vides et de structures alvéolaires.

Afin de réduire l'infiltration, on a entrepris un programme de cimentation qui consistait à obturer les vides et à détourner l'écoulement des eaux. On a donc injecté du ciment et des coulis de polyuréthannes hydrophobes et de polyuréthannes hydrophiles.

Ce programme a réussi a restreindre la venue d'eau à un debit maîtrisable. On a découvert, par ailleurs, que le système de vides était fort vaste et, en raison de son étendue, on a dû employer du coulis au ciment (qui est moins coûteux), pour l'obturation générale des vides. Par contre, les coulis au polyuréthanne se sont avérés très efficaces comme méthode d'étanchement temporaire durant les travaux de injection permanente et passablement efficaces pour obturer les fissures moins importantes. Il n'était cependant ni efficace ni economique d'obturer les fissures rayonnant de grands vides au moyen de polyurethannes.

2.0 INTRODUCTION

In the Spring of 1990, the Domtar No. 3 Gypsum Mine in Caledonia, Ontario was experiencing significant water inflows (in the order of 200 to 300 gpm) in one portion of the mine. Groundation Engineering Contractors Limited of Georgetown, Ontario were engaged to carry out a chemical and cement grouting program with the objective of reducing the water inflow to manageable levels. By the time Groundation had started work, the flow had increased to about 500 gpm. This very rapid increase is typical in deposits of soluble material such as gypsum.

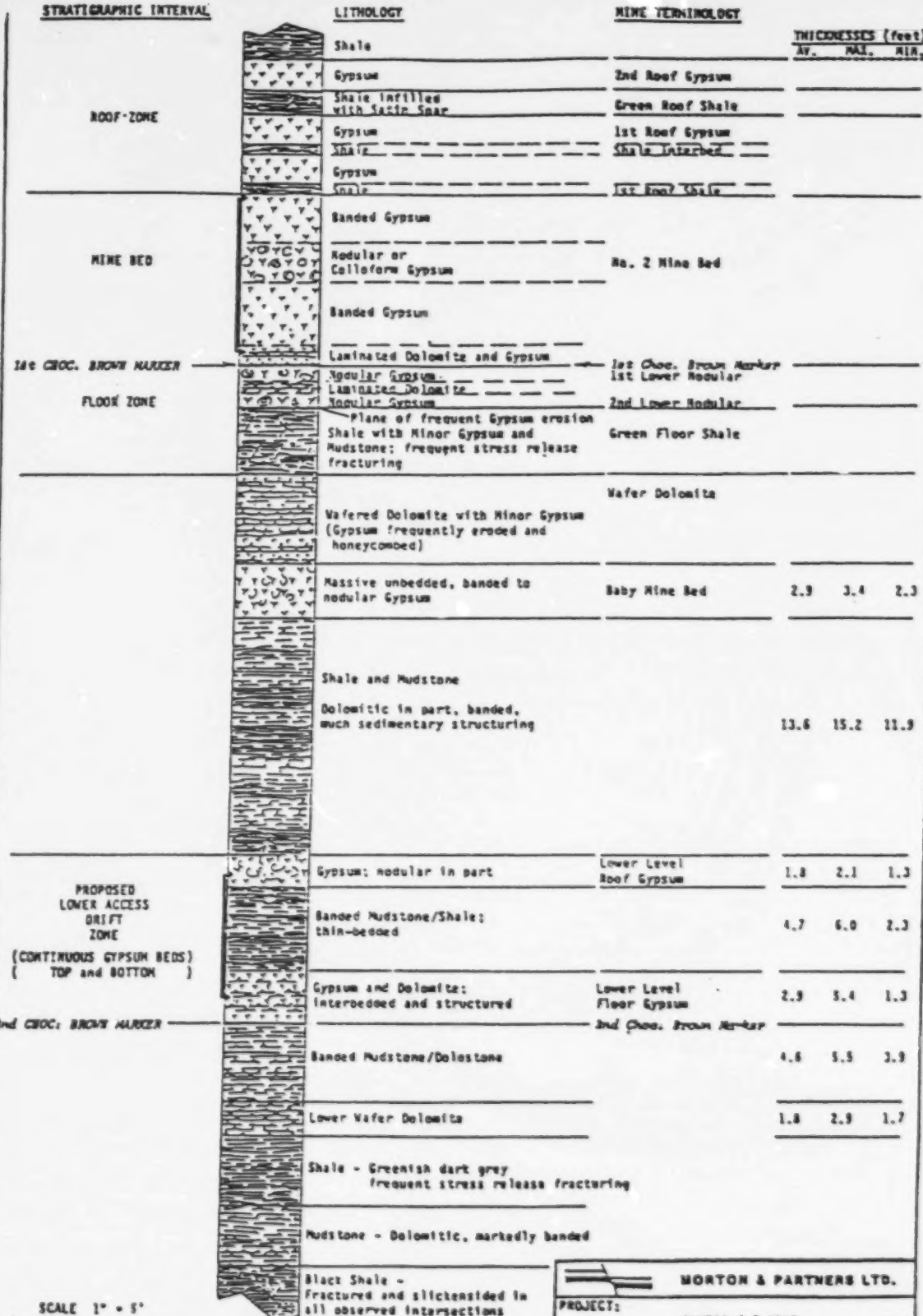
3.0 TECHNICAL DISCUSSION

3.1 General Description of the Mine

The mine layout is designed to allow vehicular access from the portal to all working faces. Entry is via a decline that starts at the portal. The first portion of this decline passes through water-bearing strata and is concrete lined. Once the water bearing strata have been passed the tunnel becomes an unlined rock tunnel. At the bottom of the decline the access tunnel travels horizontally in sound rock until it reaches the vicinity of the gypsum-bearing beds. The tunnel then rises up an incline to reach the active mining area and continues horizontally in the gypsum mine bed material to the active mining faces.

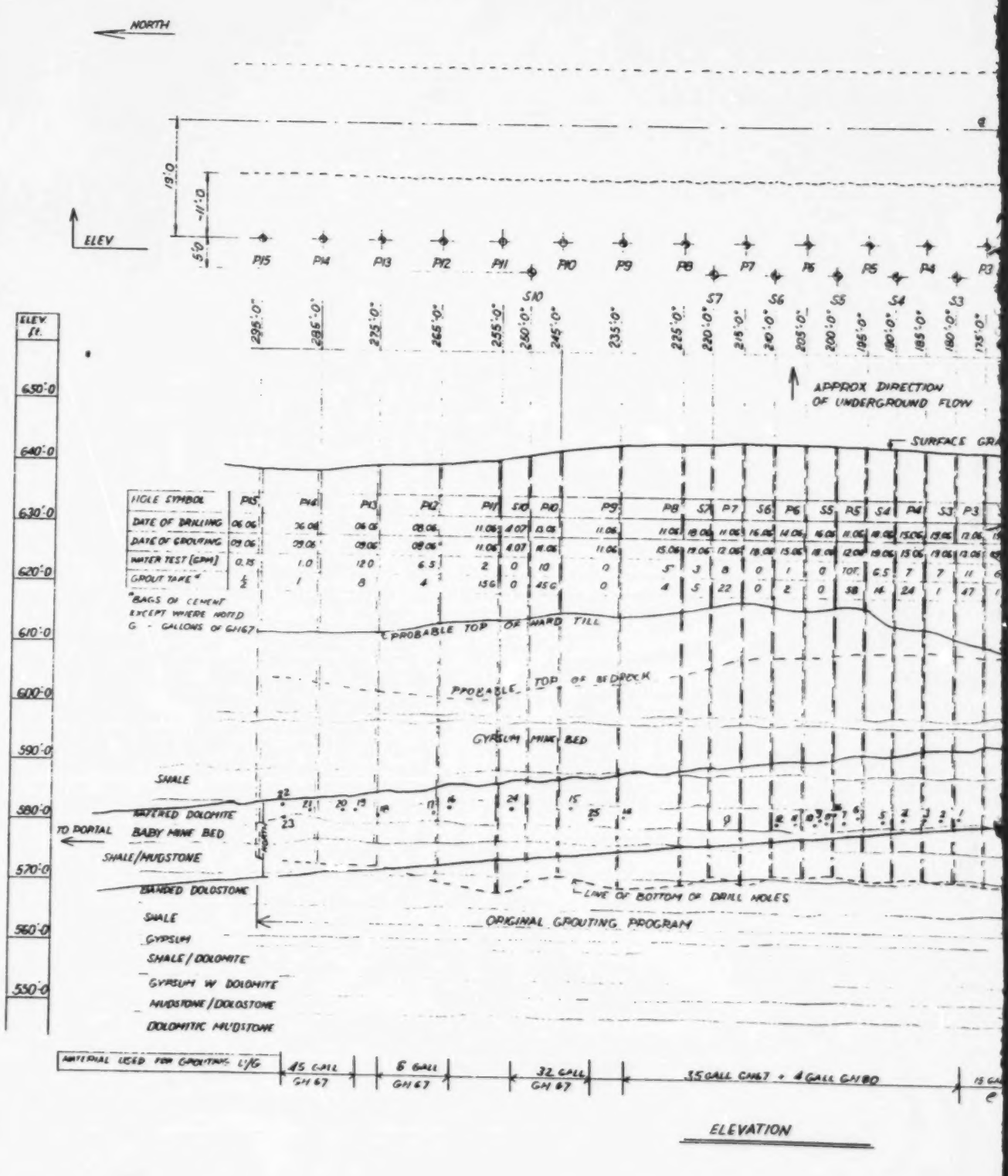
On its way up the incline the tunnel passes through a thin bed of gypsum (the "Baby Mine Bed") and a thin bed of wafered dolomite which contains minor amounts of gypsum. Towards the top of the incline, the thickness of rock over the crown of the tunnel becomes quite thin and remains so for a considerable distance. The general stratigraphy in the vicinity of the mine is shown in Figure 1.

The leakage was occurring in the upper portion of the incline, where the tunnel passes through the gypsum-bearing strata. The relationship of the tunnel to the various strata is illustrated in Figure 2.

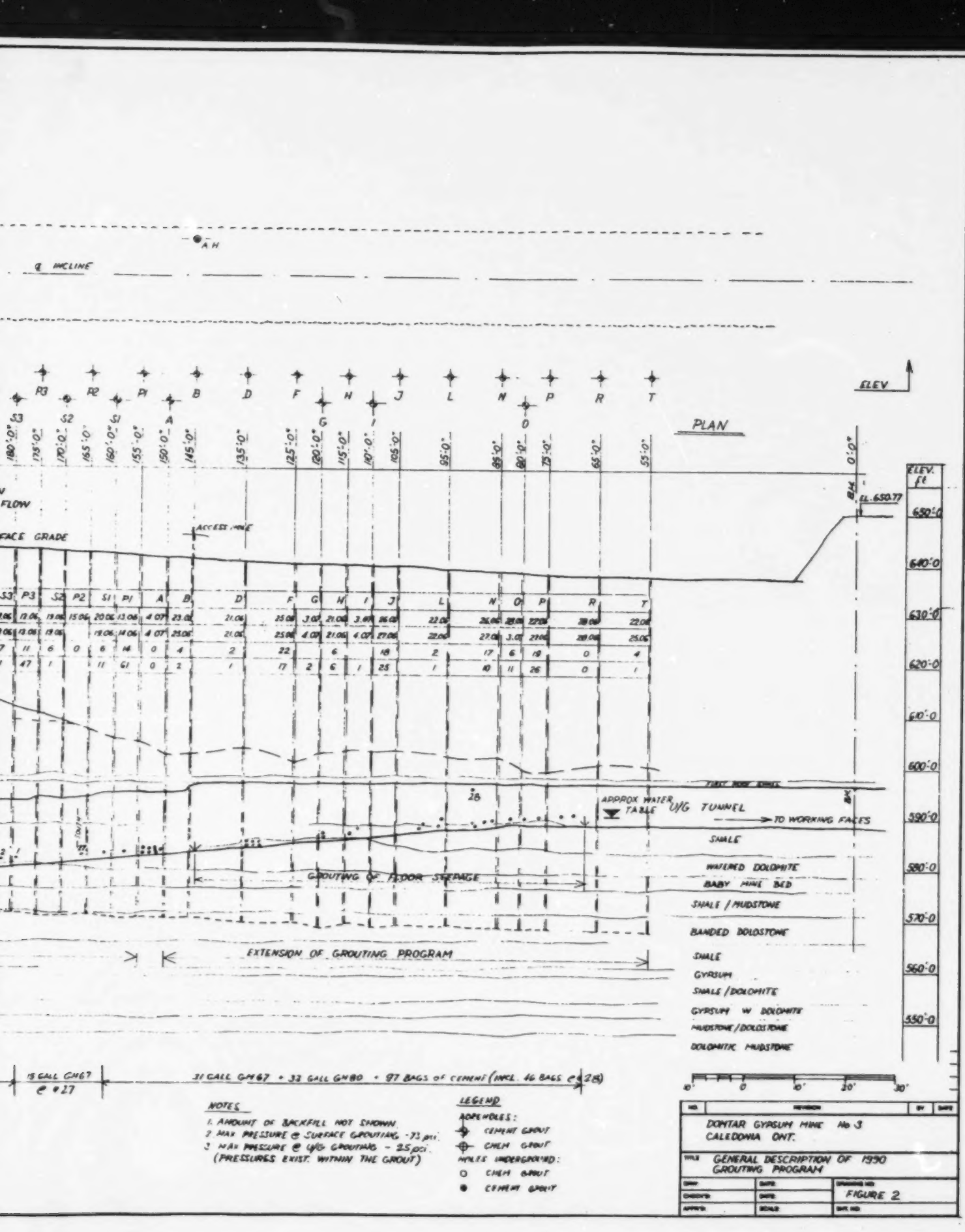


APPROX. 8-10' IN DEPTH.

FIGURE 1


NORTH
ELEV
19'-0
11'-0
59
P15
P14
P13
P12
P11
S10
P10
P9
P8
S7
P7
S6
P6
S5
P5
S4
P4
S3
P3
295'-0"
285'-0"
275'-0"
265'-0"
255'-0"
260'-0"
245'-0"
235'-0"
225'-0"
220'-0"
215'-0"
210'-0"
205'-0"
200'-0"
195'-0"
190'-0"
185'-0"
180'-0"
135'-0"
APPROX DIRECTION OF UNDERGROUND FLOW
SURFACE GRA
HOLE SYMBOL
DATE OF DRILLING
DATE OF GROUTING
WATER TEST (GPM)
GROUT TAKE*
*BAGS OF CEMENT EXCEPT WHERE NOTED G - GALLONS OF GH67
PROBABLE TOP OF HARD TILL
PROBABLE TOP OF BEDROCK
GYPSUM MINE BED
SHALE
LAYERED DOLOMITE
BABY MINE BED
TO PORTAL
SHALE/MUDSTONE
BANDED DOLOSTONE
SHALE
GYPSUM
SHALE/DOLOMITE
GYPSUM W DOLOMITE
MUDSTONE/DOLOSTONE
DOLOMITIC MUDSTONE
LINE OF BOTTOM OF DRILL HOLES
ORIGINAL GROUTING PROGRAM
ELEV ft.
650'-0
640'-0
630'-0
620'-0
610'-0
600'-0
590'-0
580'-0
570'-0
560'-0
550'-0
MATERIAL USED FOR GROUTING L/G
45 GALL GH 67
6 GALL GH 67
32 GALL GH 67
35 GALL GH67 + 4 GALL GHBD

ELEVATION



NOTES

1. AMOUNT OF BACKFILL NOT SHOWN.
2. MAX PRESSURE @ SURFACE GROUTING - 75 psi.
3. MAX PRESSURE @ U/G GROUTING - 25 psi. (PRESSURES EXIST WITHIN THE GROUT)

LEGEND

ROPE HOLES:
- CEMENT GROUT
- CHEM GROUT

HOLES UNDERGROUND:
- CHEM GROUT
- CEMENT GROUT

NO.	REVISION	BY	DATE

DOMTAR GYPSUM MINE No 3
CALEDONIA ONT.

TITLE: GENERAL DESCRIPTION OF 1990 GROUTING PROGRAM

DRAWN	DATE	DRAWING NO. FIGURE 2
CHECKED	DATE	
APPROVED	SCALE	DWG. NO.

3.0 TECHNICAL DISCUSSION

3.1 General Description of the Mine (cont'd)

The head of water is very low, being just slightly above the mine bed to shale interface (elevation 590 approximately). The area susceptible to leakage was therefore confined to a length of approximately 150 ft. where the gypsum was naturally honeycombed and eroded and where there was groundwater available. This area is shown in Figure 2 as "Original Grouting Program".

When the program started, two kinds of leakage into the tunnel were occurring:

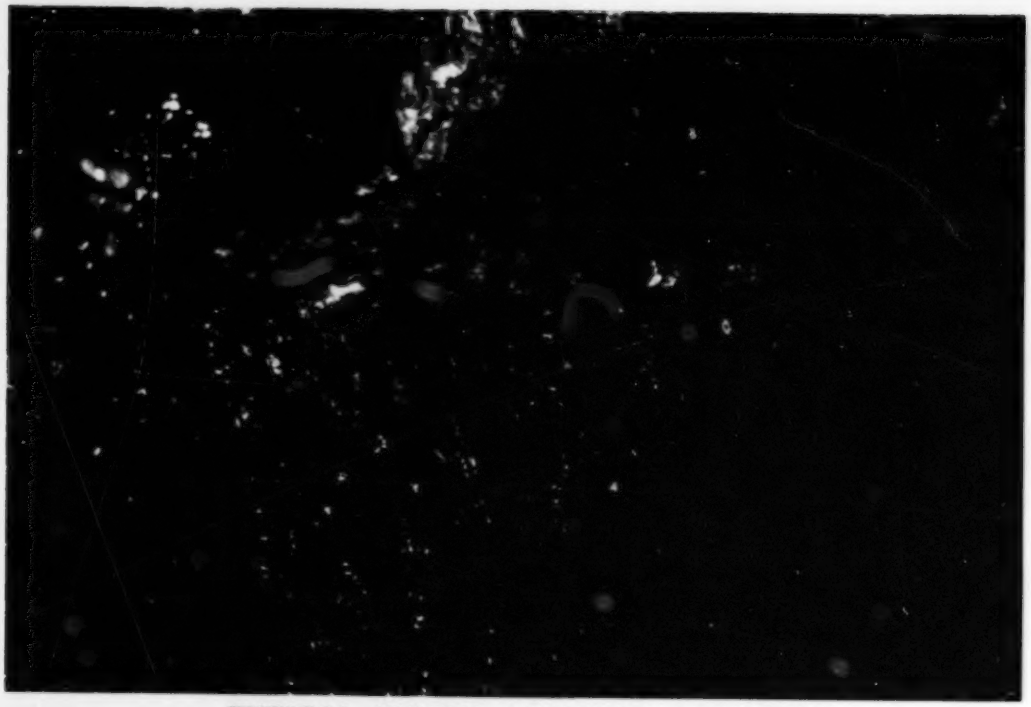
- High volume, concentrated, leaks through the tunnel wall and roof in the wafered dolomite stratum. The gypsum in this material is frequently eroded and honeycombed .

- Seepage into the floor of the tunnel from the gypsum "Mine Bed" stratum. This seepage occurs at the mine bed to shale interface, another zone where erosion of the gypsum is common.

Almost all inflow was occurring on the west side of the tunnel (the side from which the underground water was flowing). The total inflow in the affected length of the tunnel was estimated at 400 to 600 gallons per minute, with a few of the large leaks on the incline being responsible for most of this volume.

3.2 Planned Methods to Stop Water Flow

The source of the water is an underground flow which seems to be more or less perpendicular to the axis of the mine tunnel. The basic strategy planned was to create a grout curtain in the vicinity of the large inflows which would prevent the flowing water from reaching the mine tunnel. In effect, this grout curtain would deflect the flow away from that portion of the mine tunnel that was vulnerable to leakage towards other locations where the tunnel was safely above or below the porous strata. It was originally planned to used chemical grout almost exclusively to create this curtain as described below. This plan had to be modified when the true volume and nature of the existing voids became clear.



TYPICAL WATER LEAKAGE SITUATION

A SET OF LEAKS STOPPED WITH CHEMICAL GROUT

3.0 TECHNICAL DISCUSSION

3.2 Planned Methods to Stop Water Flow (cont'd)

The nature of gypsum deposits is such that an initial small flow of water can accelerate very rapidly as the flowing water dissolves the gypsum, thereby enlarging its flow passage. This process is inevitable once water starts to flow and results in the kind of leakage present in this mine when the contract started.

In order to reduce the flow rate with any permanency, it is necessary to virtually cut off all leakage into the mine (in fact all water flow in the close vicinity of the mine tunnel) so as to remove the opportunity for dissolution of the gypsum by water flows. This ideal can never be attained, so it is also desirable to plan to grout new flows immediately that they occur, and before they become well established and large in volume.

The size of some of the individual leaks in this mine was such that water flow had to be stopped before effective grouting could be done because the unrestrained leakage would carry grout material away before it had a chance to set.

Previous grouting programs undertaken in this mine had proven ineffective in the long term. Although they significantly reduced leakage in the short term, water entry re-established itself relatively rapidly. The earlier grouting program had been done entirely with cement grout which, it was felt, had not penetrated sufficiently into the small fissures to cut off all water leakage. Another failing was that the earlier program had not made a grout curtain wide enough to cut off all underground flow in the susceptible area; the water found its way around the ends of the previous grout curtain as well as re-establishing itself in imperfectly grouted fissures.

One of the expectations here was that the use of chemical grouts with controllable gel times would permit the injection and sealing of smaller fissures than could be handled with pure cement grout.

3.0 TECHNICAL DISCUSSION

3.3 Equipment Used

Drilling from the surface is carried out using the ODEX system, with casing being advanced to bedrock and uncased holes being drilled thereafter. In grouting from the surface, packers were installed to confine grout to the desired zones.

Cement grouting was carried out with conventional cement grout mixing and pumping equipment.

Chemical grouts were mixed and injected by means of a special chemical grouting plant. This plant mixes the two components as they are pumped using two, adjustable stroke, positive displacement, pumps.

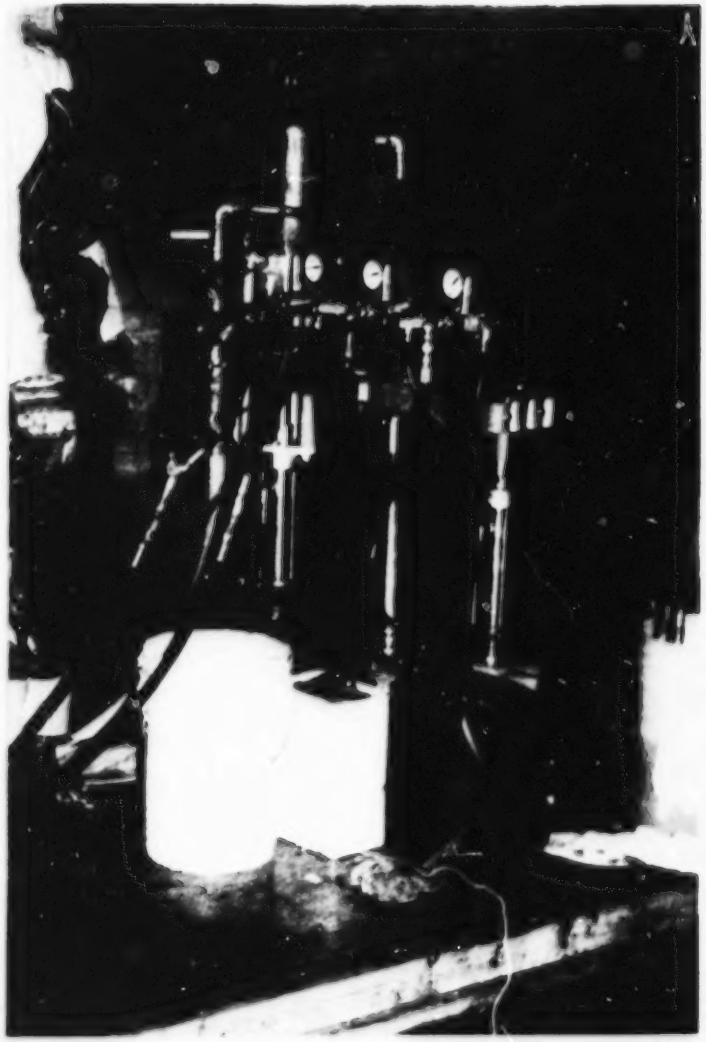
3.4 Material Used

The cement grouts were normal portland cement and water grouts with water/cement ratios ranging from 1:1 to 5:1.

The chemical grouts used were polyurethane compounds that foam or gel and expand on contact with water. Two formulations of chemical grout were used:

- RESICAST GH 80	a one component hydrophilic polyurethane system which expands and gels on contact with water or when mixed with water.
- RESICAST GH 67 with FOX-O-CAT 710	a one component hydrophobic polyurethane system with an acceleration catalyst which produces a foam.

The details of both these materials and technical specification sheets are given in Appendix A of this report.



CHEMICAL GROUT PLANT

MIXING CHEMICAL GROUT

3.0 TECHNICAL DISCUSSION

3.5 Use of the Chemical Grout

The chemical grouts were expected to perform these distinct functions:

- As water stopping agents to plug large leaks so that controlled grouting of the voids could be carried out.
- As an agent to penetrate and fill smaller voids and interconnecting passageways.
- As an agent to fill and seal finer fissures.

They were know to be unsuitable for filling large cavities.

Both the chemical grouts used were very effective as water stoppers. The GH-67 was preferable in this application. Sealing was never attempted in conditions of rapid water flow, the flow was always cut off by caulking and surface mortaring or by re-directing it through packers and diversion pipes so as to provide essentially still water for the chemical grouts to be injected into.

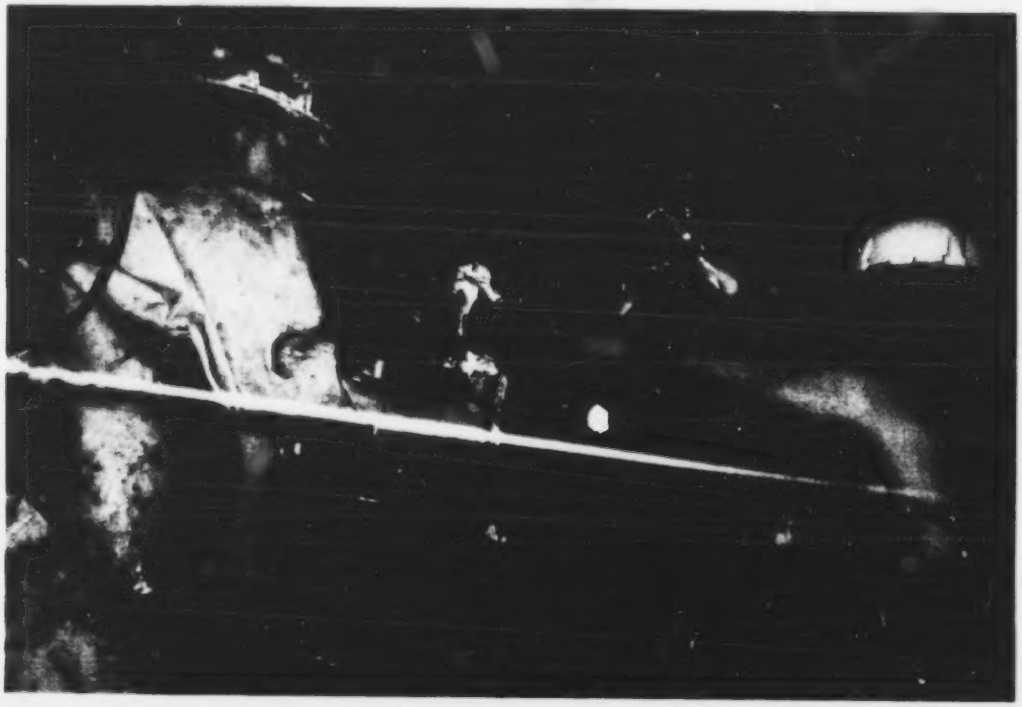
The order of work was to:

First to stop all large volume flows into the tunnel using chemical grouts and water stopping techniques;

Secondly, to create a cut-off grout curtain using the bore holes from the surface;

And thirdly, to grout any residual leakage from inside the tunnel using chemical grouts.

Chemical grouting work was initially carried out using the GH-67 grout. This grout was first used in preference to GH-80 because it was believed that better control could be obtained over the gel time with GH-67 material by varying the quantity of accelerator (FOX-O-CAT). The GH-80 is a one part material that does not have the same potential since the gel time is theoretically adjustable only by varying the proportions of water to neat GH-80 in the initial mixing.



CAULKING LEAKS TO HOLD GROUT

INJECTING CHEMICALS AND BLEEDING OFF WATER UNTIL FOAM EXITS THE PIPE

3.0 TECHNICAL DISCUSSION

3.5 Use of the Chemical Grout (Cont'd)

Some variation in gel time of the two products also occurs depending on the temperature of the grout itself and of the water that it is being mixed with and injected into.

In the case of void and fissure filling, it became clear that the GH-67 was less suitable than the GH-80 for this application.

The GH-67 is mixed with catalyst and then injected neat into the voids. It requires the presence of moisture to indicate the foaming reaction. It was found that the carrying distance and fissure penetration was poor with this product, the grout was gelling too quickly for this situation. The material would start to foam very quickly after injection. This was found to be the case even for very low concentrations of the FOX-O-CAT catalyst.

It is surmised that the problem has to do with the fact that, when the GH-67 plus catalyst mix is injected neat into large voids, it combines with the available large quantity of water upon contact and quickly starts to foam. At the contact surface the concentration of GH-67 is high and the reaction time is consequently rapid. The rapid foaming/gelling of the perimeter of the injected grout mass inhibits travel and penetration.

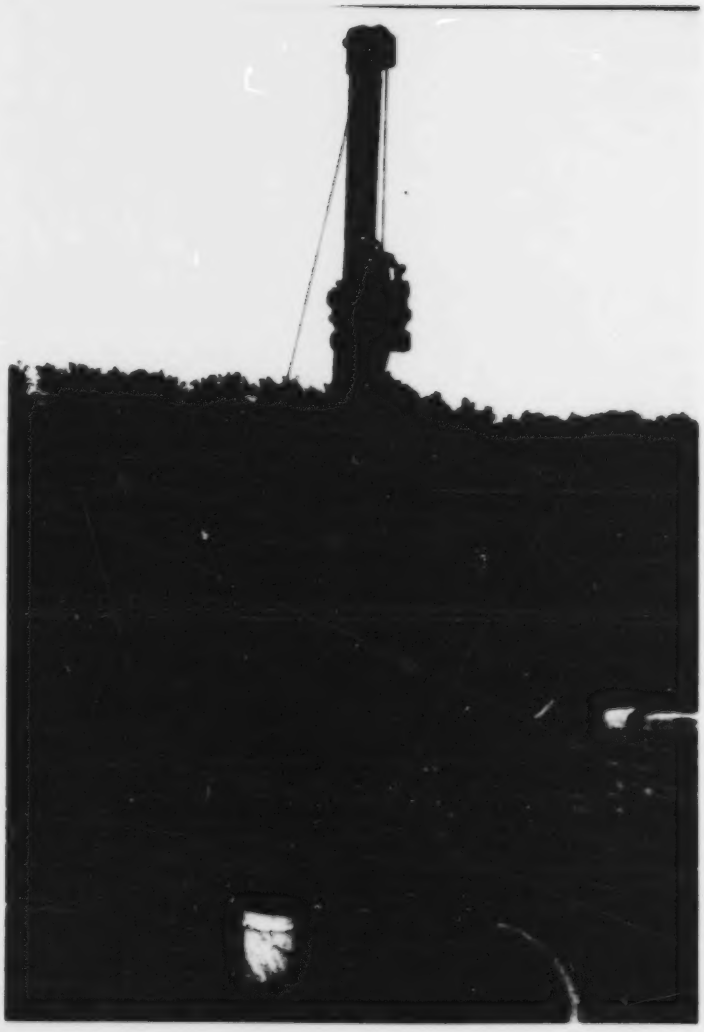
As well, a "free foaming" reaction can create large and irregular gas bubbles (rather than small, dispersed, regular bubbles) in the middle of the grout mass making the grout mass ineffective as a sealant, brittle and porous.

The performance of GH-67 in penetrating thinner fissures and small voids (which have relatively little volume of water) was good.

The GH-80, by contrast, is a gel grout rather than a foaming grout. It is mixed with water at the mixing head (in this case in the ratio of 6 parts water to 1 part GH-80) and so never attains the high concentrations that could lead it to "flash" gelling. Its performance in penetrating and sealing cracks was fair to good in the smaller fissures and water passages.

4 SURFACE HOLES READY FOR GROUT

THE THIN HOSES ARE FOR THE PACKERS



DRILLING FROM THE SURFACE

3.0 TECHNICAL DISCUSSION

3.5 Use of the Chemical Grout (Cont'd)

Neither chemical grout was effective in achieving good penetration from large voids into small fissures. It is believed that the presence of large volumes of water in the large voids would cause a degree of "flash" gelling or "free foaming" as described above and that the surface of the grout mass would then be too viscous to penetrate thin fissures when it reached them.

In general, the chemical grouts were found to be flowing laterally along the tunnel, rather then perpendicularly back into the rock: i.e. they were following the path of least resistance. This relatively poor perpendicular penetration should be seen as a result of the make-up of the void system. There was some exceptions to this; for example, chemical grout from hole #27 was found to have filled surface bore hole P2.

Injections of chemical grout were made in two boreholes from the surface. This proved troublesome in two ways:

- It was found that the void volume to be grouted was often very large. Consequently the initial grout was reaching its cream time before the main volume of the void was properly filled. This stiffening of it's consistency appeared to prevent it penetrating properly into the smaller fissures connected to the main body of the void. It was therefore felt that one of the primary purposes of the chemical grouting, namely the penetration of small fissures, could not be achieved when large grout volumes were required just to fill cavities in the rock.

- The use of the expensive chemical grout to fill large spaces which could equally well be filled with a cement grout was felt to be wasteful and inappropriate to the purposes of this program.

Accordingly, all other surface injection was done with cement grouts. In the later stages, cement grout was also used underground when large voids were encountered.

3.0 TECHNICAL DISCUSSION

3.5 Use of the Chemical Grout (Cont'd)

The composition of the chemical grouts does not permit their use with uncured cement grouts. The manufacturer of these products notes that the chemical grouts degrade in the presence of uncured cement. The manufacturer advises that there are no adverse effects once the cement grout has cured. Because of this property, it is not possible to combine cement and polyurethanes in a single injection.

3.6 Surface Grouting Program

The work from the surface consisted of drilling a row of primary grouting holes at approximately 10 ft. centres, parallel to the tunnel axis, on the upstream side of the tunnel (west side) and approximately 11 ft. removed from the tunnel wall. These holes were generally drilled into the shale/mudstone below the Baby Mine Bed. This shale/mudstone material is not pervious to water.

Primary grouting, generally with cement grout, was done through this first row of holes as an initial cut-off. Where leakage persisted, a secondary row of holes approximately 5ft. further away from the tunnel was drilled and more grout was injected.

All holes were water tested prior to grouting and the rate of take recorded in gallons per minute. During this process, and the subsequent grouting, injection was confined to the desired rock strata by the use of a packer in the hole above the zone to be grouted. Typically, 4 holes would be drilled, cased, water-tested and then grouted as one unit of work. In the case of significant take, dyes would be used to determine whereabouts in the tunnel the flow was appearing. In cases with a large flow, it was usually necessary to stop up the point of influx of the water into the tunnel so as to be able to contain the grout until it was set. This was done working from underground using the concentrated chemical grout as a water stopper.

3.0 TECHNICAL DISCUSSION

3.6 Surface Grouting Program (Cont'd)

An attempt was made to grout from the surface using the chemical grouts partway through the program but this was quickly abandoned when it was found that the quantities involved could be enormous (the second hole attempted took 45 gallons of chemical grout). All surface drilling and grouting was then changed to the use of cement grouts which are more cost effective for filling up large voids.

Grout take in the primary holes was from 1 to 61 bags per hole. These large takes confirm the presence of an extensive void system in the gypsum material.

In all, 37 holes were drilled from the surface over a length along the tunnel axis of 240 ft.

4.0 PROJECT STATISTICS

Schedule

Start work	31 May 1990
Drill and grout underground (original scope)	31 May to 7 June
Drill and grout from surface	9 June to 12 July
Drill and grout Underground (added scope)	27 June to 11 July
Work completed	12 July 1990

Drill and Grout Underground (Original Scope)

No. of holes		27 each
Volume of chemical grout	- GH67	135 Gallons (Imperial)
	- GH-80	4 Gallons (Imperial)
Volume of cement grout		None

Drill and Grout From Surface

No. of Hole		37 ea. x 72' avg. length
Volume of Chemical Grout	-GH67	60 gallons (Imperial)
	-GH80	None
Volume of cement grout		366.5 bags

Grouting pressures
- Cement 45 psi at surface (75 psi at bottom)
- Chemical 1 psi at surface

Chemical grouting halted when take fell below 0.25 gpm
Cement grouting halted when take fell below - 1.0 gpm for 1:1 grouts
- 0.25 - 0.50 gpm for 4:1 grout

Largest take	-Cement grout	61 bags in hole P1
	-Chemical grout	45 gallons in hole P10

Drill and Grout Underground (Added Scope, Uphill of Original Scope)

No. of holes		35 each
Volume of chemical grout	- GH-67	31 gallons
	- GH-80	33 gallons
Volume of cement grout		97 bags

Grouting Pressures

Cement grout	25 psi max.
Chemical grout	10 psi max.

Total Volumes Used

GH-67	-	226	Imperial gallons
GH-80	-	37	Imperial gallons
Cement	-	464	Bags

Supply and Services Canada / Approvisionnements et Services Canada

CONTRACT PLAN AND REPORT FORM – FORMULE DE PROJET DE CONTRAT ET DE RAPPORT

DSS-MAS 9143-3 (4/82)

CONTRACT TITLE – TITRE DU CONTRAT : A REPORT ON AN UDERGROUND CHEM. GROUTING PROJECT

CONTRACTOR – ENTREPRENEUR : DOMTAR GYPSUM

FILE NO. – Nº DU DOSSIER	SERIAL NO. – Nº DE SÉRIE
007SQ.23440-9-9121	23440-9-9121/01-SQ

TASK DESCRIPTION DESCRIPTION DE LA TÂCHE	TASK DURATION IN MONTHS – DURÉE DE LA TÂCHE EN MOIS 1 MAY · 2 JUNE · 3 JULY · 4 AUGUST · 5 · 6 · 7 · 8 · 9 · 10 · 11 · 12	TASK COST – COÛT DE LA TÂCHE PLANNED PRÉVU À L'ORIGINE	ACTUAL PRÉSENTEMENT	E.T.C. À VENIR
1) MOBILIZATION		$5,000	$5,000	
2) DRILLING & GROUTING FROM SURFACE		$55,967	$100,150	
3) DRILLING & GROUTING UNDERGROUND		$38,044	$ 59,326	
4) DEMOBILIZATION		$5,000	$ 5,000	
5) REPORT		$6,000	$ 3,000	$3,000
PLANNED COST BY MONTH COÛT PRÉVU POUR CHAQUE MOIS		PLAN $110,011		
ACT. PRÉSEN. / E.T.C. BY MONTH PRÉVISION POUR CH. MOIS			ACTUAL COÛTS RÉELS $172,476	E.T.C. À VENIR $3,000

5.0 OBSERVATIONS

It was found that the volume of groutable void within the rock was considerably larger than had been expected and was also larger than would be predicted from the amount of leakage seen in the tunnel. This large void volume would indicate that, without grouting, there would be a permanent potential for large scale leakage to erupt again once water found passage from the void system to rock surface and the initial small flow then began to dissolve the gypsum.

Almost all the flowing water was in the gypsum inclusions rather than in actual fissures in the rock. These gypsum inclusions are extensively interconnected horizontally. Vertical connection was rare. In some instances dye injected in a surface borehole would appear in the tunnel approximately 50 ft. away from the bore hole location.

Either chemical grout was effective as a water stopping agent and is recommended for that purpose.

As the leakage was blocked off and the grout curtain injected, new points of leakage erupted. It was clear that the presence of the grout curtain and of the water-stop grouting was raising the water table and allowing the underground water to reach pre-existing, but previously dry, points of ingress into the tunnel. It was partly because of this spread of the points of active leakage that the grouting program had to be extended.

This shifting of the points of water ingress was not very marked when only water-stop grouting was being done. Once the injection of the grout curtain started, the points of leakage spread rapidly uphill.

Leakage did not extend very far downhill because the tunnel quickly passed through and below a shale zone which cut it off from whatever the water might have been doing above.

As the grout curtain and the water stop grouting was carried out some leaks appeared on the east side of the tunnel which had previously been dry.

5.0 OBSERVATIONS (Cont'd)

Whether or not a bore hole from the surface would intercept the void system was not predictable. It was clear from the pattern of grout takes in the various bore holes etc. that the voiding system was extensive but intricate, rather then just wide spread.

It was observed that when grouting was being carried out from the surface bore holes, the injection of the grout in these bore holes would accelerate the leakage into the tunnel temporarily.

6.0 CONCLUSIONS

The grouting program that was undertaken effectively cut the inflow of water to a manageable level. Because of the soluble nature of gypsum it is very easy for flows to quickly re-establish themselves at large volume starting from any residual, ungrouted, leakage paths. One of the purposes of this grouting exercise was to attempt to seal these small leakage paths and so increase the time before the re-occurrence of major inflows. It is doubted that <u>any</u> grouting program would provide truly long term security from inflow given the type of materials encountered in this mine.

One of the purposes was to test the effectiveness of various polyurethane grouts as a means for sealing these cracks. These materials have some undesirable characteristics for the nature of voiding that is found in gypsum bearing rocks. They were found to have a tendency to "flash" gel or "free foam" in the larger voids thereby becoming too viscous to penetrate into adjacent smaller fissures. The GH-80 material was better than the GH-67 in large voids.

The polyurethane grouts were very effective as water-stop grouts when used from inside the tunnel. The GH-67 is superior for this application.

In gypsum-bearing materials it is recommended to use cement grouts first in order to fill the typically large voids with a cheap material. This can then be followed up by chemical grouting of the remaining fissures etc. Prior to cement grouting, active leaks should be stopped using the polyurethane.

6.0 CONCLUSIONS (Cont'd)

Given the intricate nature of the void system in these materials, it is not possible to grout all water passages full. It will not, therefore, be possible to stop all leakage for an extended period. It will be possible to control leakage by prompt grouting of new water flows.

It can be expected that the water inflows now prevented from reaching the tunnel through the west wall will find new passages and will start to flow from the previously dry east wall

APPENDIX A

Technical information
Technische informatie
Technische Hinweise
Information technique

Ref. no. RC 533 E

RESINA CHEMIE

RESICAST GH 67/FOX-O-CAT 710

PUR injection grout as a so-called waterstop system.

DESCRIPTION

RESICAST GH 67/FOX-O-CAT 710 as such is a one component polyurethane consisting of a isocyanate component (RESICAST GH 67) and a special type of catalyst (FOX-O-CAT 710). RESICAST GH 67 is based on crude MDI in combination with polyether polyols produced by
Resina Chemie.
This PUR system only reacts when it comes in contact with water giving a relatively stiff polyurethane foam.

CHARACTERISTICS

. solvent and filler free
. outstanding resistance to water
. physiologically harmless

APPLICATION

RESICAST GH 67/FOX-O-CAT 710 is a complete system, that is ideally suited for sealing of cracks and breaks in concrete structures with water leakage problems. Especially in cases of running water or cracks filled with water RESICAST GH 67/FOX-O-CAT 710 is advised, because the water is stopped and/or reacted away. To get an optimal repair the crack should be injected with RESICAST GH 40/URESTYL 1100 for an elastic joint or with RESICAST GH 65/URESTYL 1100 for structural repair after using RESICAST GH 67/FOX-O-CAT 710.

OPERATION

To get a controlled reaction with the water the geltime can be adjusted by adding the catalyst FOX-O-CAT 710 to the RESICAST GH 67.

RESINA CHEMIE B.V.
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Tel. (0) 5980 - 1 79 11
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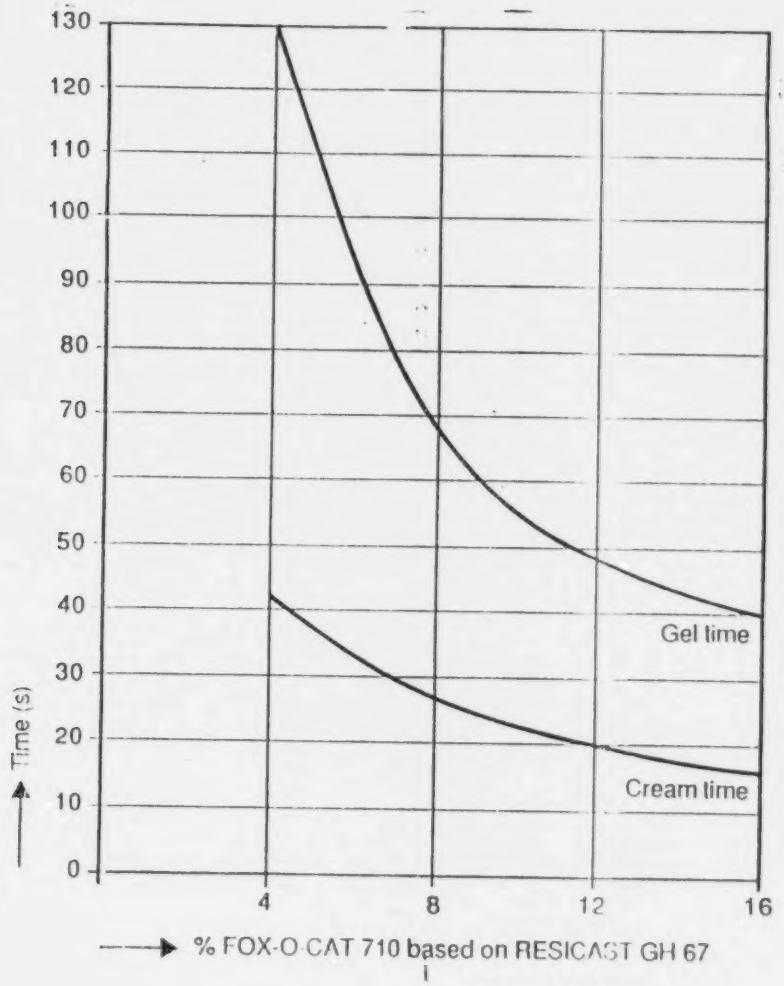

Testrecipe:
100 parts by weight RESICAST GH 67
x parts by weight FOX-O-CAT 710
20 parts by weight Water

Dependent of the velocity of the running water or the amount of water expected in a crack the geltime should be fixed before injection. Adjust the amount of FOX-O-CAT 710 and mix this proper into the RESICAST GH 67. Avoid mixing humid air into this material.
The ready mix can be pumped by means of a single component injection pump, that is equipped for higher pressure. This is necessary to withstand the water pressure.
After the injection the pump must be cleaned with methylene chlorid or 1,1,1 trichloroethane (these products may not contain any water).

Technical information
Technische informatie
Technische Hinweise
Information technique

Ref. no.

RESINA CHEMIE

PHYSICAL CONSTANTS OF THE LIQUID COMPONENTS	RESICAST GH 67	FOX-O-CAT 710
Colour	brown	clear
Specific gravity at 20°C (kg/m3)	1120...1140	930...950
Viscosity at 25°C mPa.s	300	50
Potlife at 20°C hours	6	
Storage stability* months	6	6

* in well sealed drums.

INSTRUCTIONS FOR USE

To prevent condensation on the liquids, at the start of the operation the temperature of the components should be adjusted to the ambient temperature (20...25°C).

SAFETY PRECAUTIONS

When handling the raw materials and components, care should be taken to prevent the liquids from coming into contact with the skin and eyes. Avoid also inhalation of their vapours. Detailed safety precautions, which should be observed during the operation, are given in our leaflet RC 150 E "Safety precautions when handling polyurethane raw materials and components".

All information in this brochure is based on our practical experience and reliable laboratory evaluations. Nevertheless, we cannot assume any responsibility for its utilization, the circumstances under which the products are stored, handled and used being beyond our control.
For detailed information and advice our technical sales staff are always pleased to be of service.

Technical information
Technische informatie
Technische Hinweise
Information technique

Ref. no. RC 568 E

RESINA CHEMIE

RESICAST GH 80 - PUR GROUT

DESCRIPTION

RESICAST GH 80 is a one component polyurethane system, containing an isocyanate.
RESICAST GH 80 dissolves in water and transforms with the water into an elastic material which features excellent water-stopping properties.

APPLICATION

RESICAST GH 80 reacts with water to form a gel.

RESICAST GH 80 dissolves in water in free ratio and forms a gel.
(Minimum concentration: 4 %).

RESICAST GH 80 is very suitable for stoppage of leaks and heavy waterflow into structures.

RESICAST GH 80 reacts even with sea water and mineral water, regardless of water temperatures.
Even heavy waterflows can stopped.
The adhesion on the surfaces is excellent. After reaction the product obtained is a chemically stable and non degradable elastomer.

INSTRUCTIONS FOR USE

To prevent condensation on the liquid at the start of the operation the temperature of the component should be adjusted to the ambient temperature.

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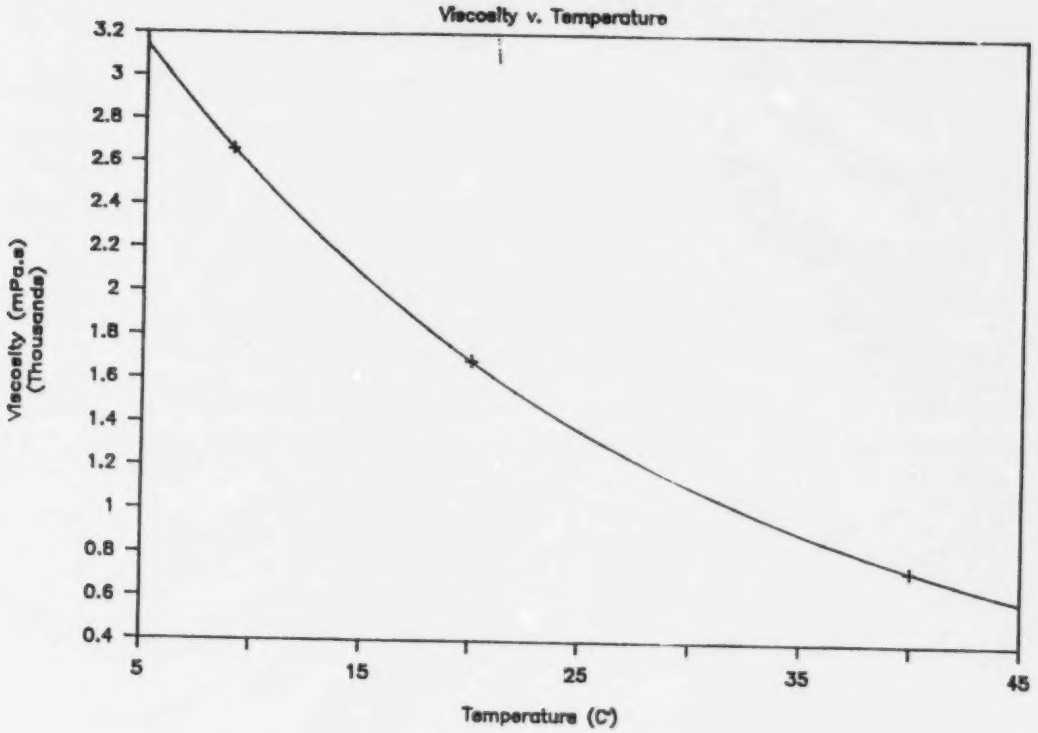
RESICAST GH 80



PRECAUTIONS FOR APPLICATION

In respect of the practical application care is to be taken that no water soluble RESICAST GH 80 is used in combination with water glass type or regular cement type grout as in that case the quality of the cured gel will be degraded.

It should also be avoided to inject original liquid of RESICAST GH 80 or to inject a too highly concentrated (more than 50 %) solution, because excessive foaming with inherent swelling pressure may occur, which might lead to partial destruction of the construction(s) injected.

Since RESICAST GH 80 contains solvent, it may cause swelling or deformation of plastics e.g. vinyl chloride.

It should strictly be observed to keep RESICAST GH 80 containers away from fire.

Technical information
Technische informatie
Technische Hinweise
Information technique

Ref. no.

RESINA CHEMIE

OPERATION

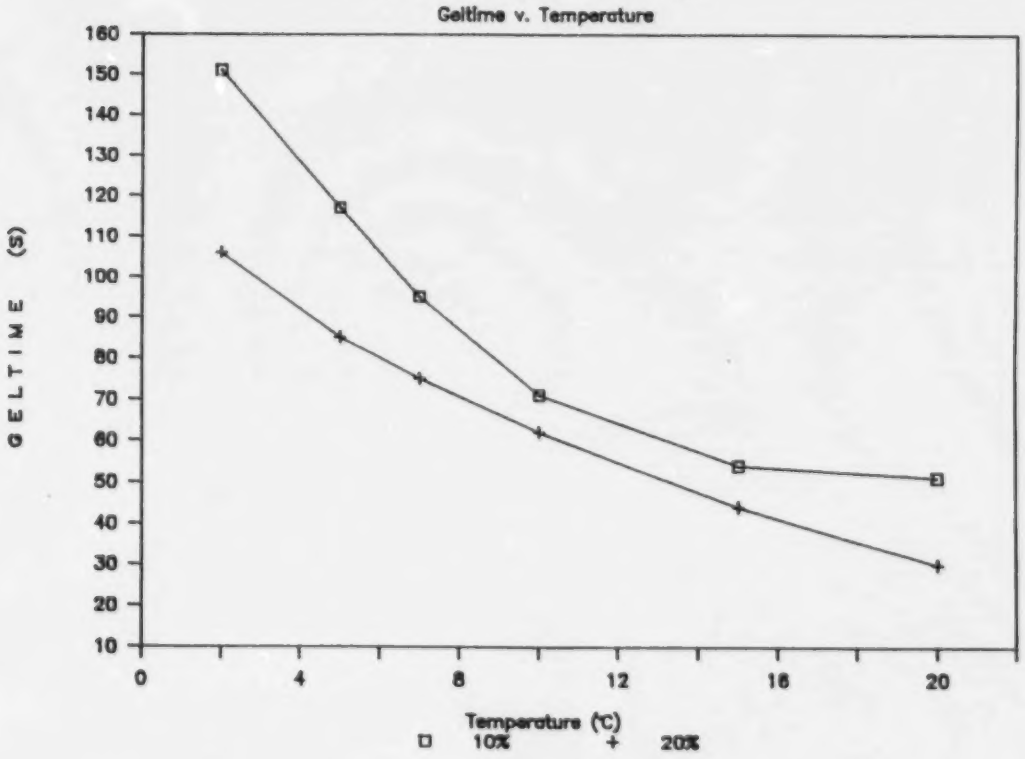
Gelproperties of RESICAST GH 80 at 20°C

Gel concentration (%)	Gel time (s)	Swelling at 1 atm. (times)	Gel strength 100=1 cm*	Gel condition **
5	79	1.0	270	soft gel
10	41	1.0	130	h.r.gel
20	30	1.4	70	h.r gel
30	30	2.0	70	h.r gel
50	25	2.9	70	h.r/h.f.gel

* By Penetrometer

** gel = resilient
h.r. gel = highly resilient
h.f. gel = highly foaming

RESICAST GH 80



Conc. in water.

SAFETY PRECAUTIONS

Eye and skin protection.
Safety glasses and rubber gloves should be used during handling. In case of skin contact with the liquid, immediately wash with water. Liquid getting into the eyes should be flushed out immediately with plenty of water for at least 15 minutes; an occulist should be consulted.

Ventilation of working invironment

Use only under well ventilated conditions, especially when injection is carried out in underground areas like tunnels, etc.

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